

ABSTRACT

The invention provides a process, catalyst and apparatus for carrying out the water-gas shift reaction comprising employing a low-pyrophoricity water-gas shift reaction catalyst; wherein the low-pyrophoricity water-gas shift reaction catalyst comprises a solid high heat capacity particulate support impregnated with: (i) a reducible metal oxide and (ii) a catalytic agent.

09771532, 015001

UNITED STATES PATENT AND TRADEMARK OFFICE
DOCUMENT CLASSIFICATION BARCODE SHEET



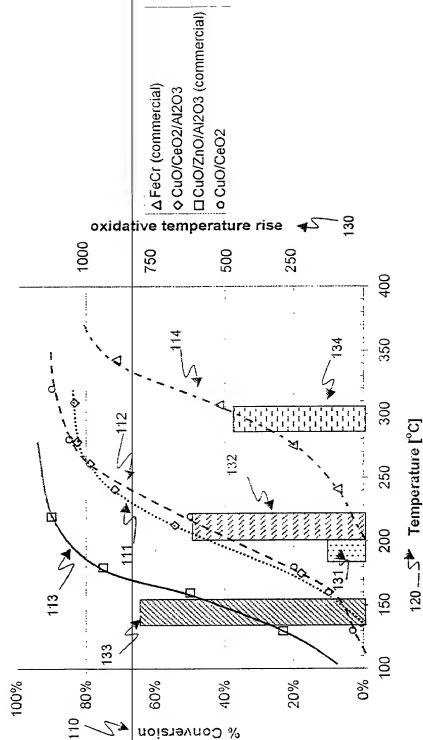
Drawings

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Figure 1

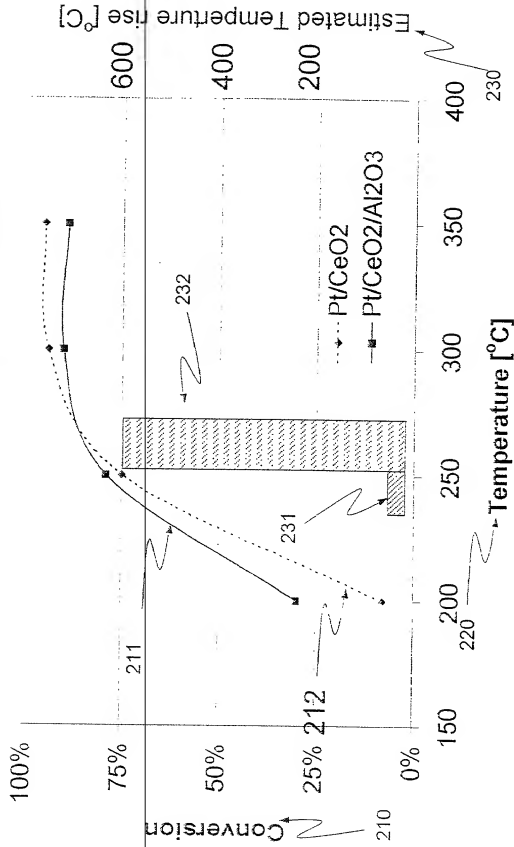
Activities (lines) and pyrophoricity (columns) of
 FeCr , $\text{CuO/ZnO/Al}_2\text{O}_3$, CuO/CeO_2 and $\text{CuO/CeO}_2/\text{Al}_2\text{O}_3$
 2% CO , 10% H_2O , 20% H_2 , 5% CO_2 ; VHSV = 5,000 h^{-1}



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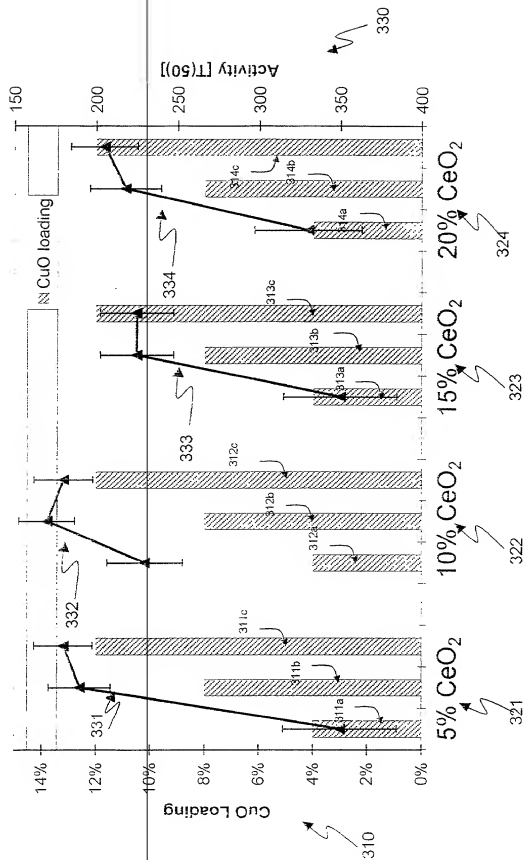
Comparison of activity (lines) and pyrophoricity (columns) of Pt/CeO₂ and Pt/CeO₂/Al₂O₃ catalysts

0.5% CO, 20% H₂, +10% H₂O, WHSV=24,000 h⁻¹

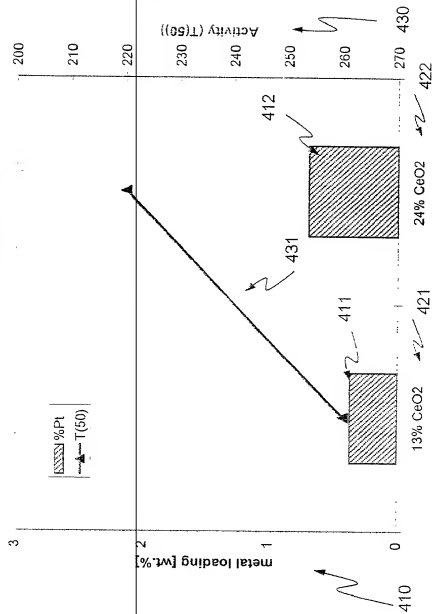


Dependence of WGS activity on Ce- and Cu-loading
(18,846-29+38, samples WR-66,75, exp. WR-67,76,78)

test conditions: 2% CO, 20% H₂, +10% H₂O balance N₂ WHSV = 30,000 h⁻¹

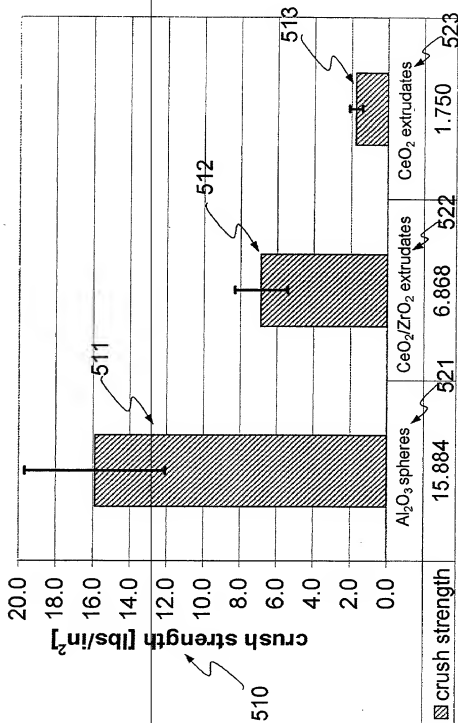


Effect of Ce and Pt loading on the activity of Pt/CeO₂/Al₂O₃ catalysts
0.5% CO, 20% H₂, +10% H₂O, WHSV=24,000 h⁻¹



Crush strength of catalyst support particles

Average and standard deviation of 20 samples



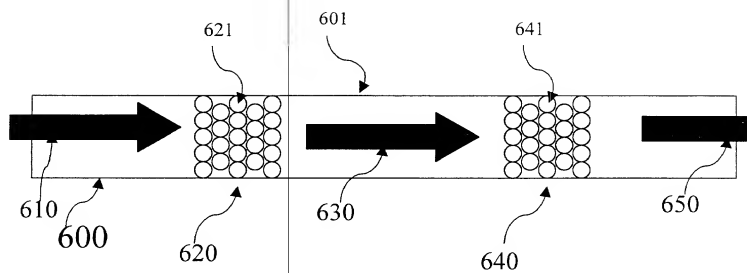


FIG. 6

Figure 7: Effect of Cr_2O_3 Level on the Catalytic Activity of $\text{CuO}/\text{Al}_2\text{O}_3$ WGS Reaction Catalysts

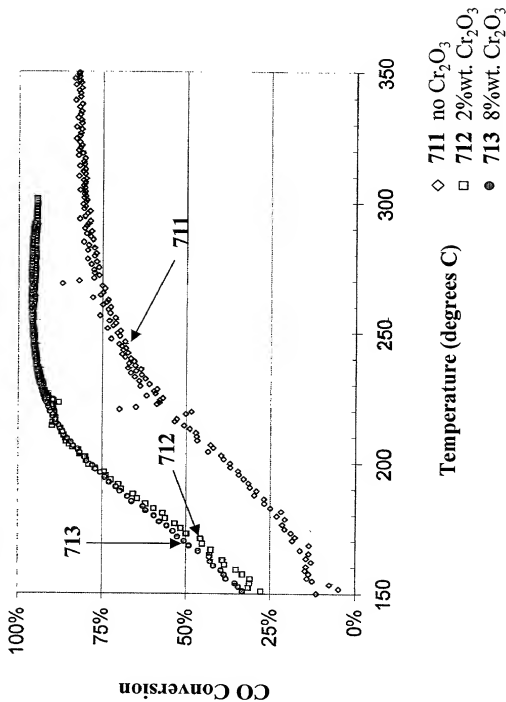


Figure 8: Effect of Cr_2O_3 Level on the Catalytic Activity of $\text{CuO}/\text{CeO}_2/\text{Al}_2\text{O}_3$ WGS Reaction Catalysts

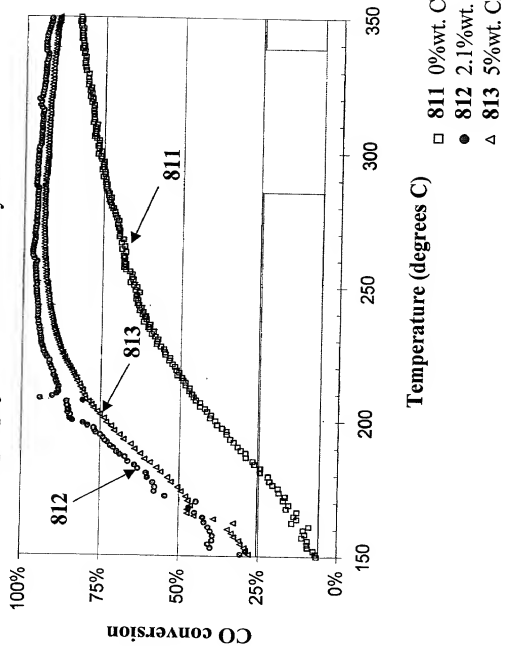


Figure 9: Effect of the Sequence of Synthetic Steps on the Catalytic Activity of $\text{CuO}/\text{Cr}_2\text{O}_3/\text{CeO}_2/\text{Al}_2\text{O}_3$ WGS Reaction Catalysts

